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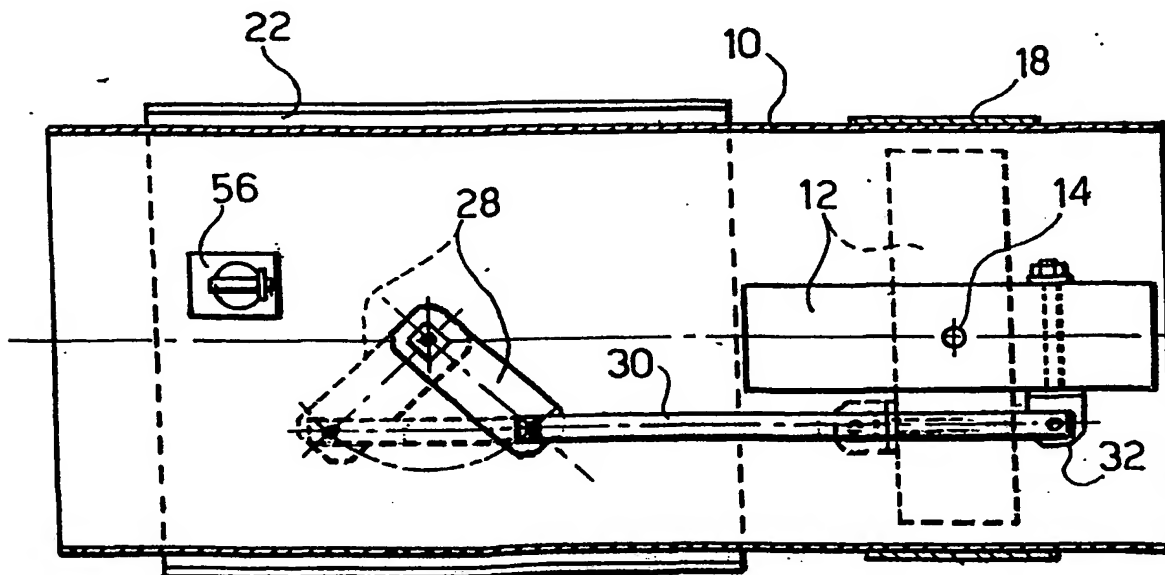
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(54) **Shutter device for ventilation ducts, particularly as fire-arrester**

(57) A fire-shutter (12) is rotatable within a duct (10) between an open and a closed position. A shutter-tripping unit supported on a base plate (22), mounted externally on the duct, has a heat sensor (56) projecting within the duct and a spring-loaded mechanism triggered by the heat sensor to move the shutter to a tripped

position in case of abnormal heat. The spring-loaded mechanism comprises a spring-driven rotatable shaft (24) extending through said base plate (22) and duct wall (10), a crank (28) keyed to the shaft and a linking rod (30) having one end linked to the crank and its opposite end linked to a bracket (32) carried excentrically on one side of the shutter (12).

**FIG. 3**



## Description

### SPECIFICATION

[0001] This invention is concerned with a shutter device for ventilation ducts, particularly to be used as a fire-arrester, though it can also be used for other related applications, such as a fume-dispeller.

[0002] It is well known that ventilation ducts, such as used in residential and industrial buildings, can be a hazard when a fire develops in one room, since they can convey the fire from one room to the next, unless they are provided with a fire barrier which can be closed when necessary. Such barriers generally consist of shutters journaled around an axle transverse to the duct, and they must be located exactly in the wall passage, since the frill material of the duct would otherwise allow the fire to break through the duct in the section between the fire-barrier and the wall.

[0003] The above shutters are generally operated automatically, by means of a tripping unit which senses the temperature in the duct and trips the shutter shut in case of abnormal heat. In order to insure proper operation under emergency conditions, the driving power for shutting the barrier is supplied by a preloaded spring, which is released by a retaining mechanism incorporating a low-melting fuse. A remotely controlled release is also usually provided for testing the barrier, and in that case a remotely controlled re-loading mechanism is required, usually comprising an electric motor to rotate the barrier to an open condition against the resistance of the spring, and to re-engage the retaining mechanism. One such device is described, for instance, in WO 94/26352.

[0004] One drawback of known fire-arrester devices of the above kind is that the shutter-tripping unit has to be partly or wholly embedded in the room wall, so that its installation or replacement usually requires masonry work, and in any case it makes it difficult to open the unit after installation for maintenance or repair. Although the necessity for maintenance is infrequent, it does arise whenever the above-mentioned remote testing procedure gives an unsatisfactory result.

[0005] Another drawback of known fire-arrester devices is that they generally have a shutter-operating motor (used for reloading the spring mechanism after testing) that is mounted coaxially to the shutter axle, on top of the unit case. Consequently, before the cover of the case can be removed when it is desired to access the mechanisms inside the case, it is first necessary to remove the motor and disengage it from the shutter axle. Subsequently the motor will then have to be reassembled, with even more time consumption, and by operations requiring some skill and care, which the installer is not always able or willing to exercise.

[0006] Accordingly, this invention has the object of providing a fire-arrester device for ventilation ducts, which can be installed well clear of the adjacent room wall, with straightforward operations, without extensive

masonry work.

[0007] Another object is to provide the above-mentioned fire-arrester device so that any maintenance or repair operations can be performed quickly and easily.

[0008] The above and other objects and advantages are achieved by the invention with a fire-arrester device for ventilation ducts having the features set out in claim 1.

[0009] The subordinate claims specify further advantageous features of the invention.

[0010] The invention will now be described in more detail with reference to a preferred embodiment, with the help of the attached drawings, wherein:

Fig. 1 is a view in transverse cross-section of a ventilation duct equipped with a fire-arrester device according to a preferred embodiment of the invention;

Fig. 2 is a view in longitudinal cross-section made along line II-II of Fig. 1;

Fig. 3 is a view in longitudinal cross-section made along line III-III of Fig. 1;

Fig. 4 is a plan view, on an enlarged scale, of a shutter-tripping unit according to the invention, in an armed condition;

Fig. 5 is an elevation side view of the shutter-tripping unit of Fig. 4, in an armed condition;

Fig. 6 is an end view of the shutter-tripping unit of Fig. 4, in an armed condition;

Fig. 7 is a plan view similar to Fig. 4, with the shutter-tripping unit in a released condition;

Fig. 8 is an end view of the shutter-tripping unit as shown on Fig. 6, in a released condition.

[0011] With reference to Figures 1 to 3, a metal-plate ventilation duct 10 is provided with a thick, disc-shaped fire-shutter 12, made of a fire-retardant material, which is mounted for rotation about pivots 14 that are located in the duct at a position coinciding with a passage through a wall 16 (shown in dotted lines on Fig. 2) of a room where the duct is installed. A temperature-driven expansion belt 18 surrounds duct 10 at the position of the shutter pivots and is adapted to shrink the duct wall against the periphery of the fire-shutter in case of fire, as known per se.

[0012] A platform 20 is welded on top of duct 10, at some distance from wall 16, and a flat, ribbed metal plate 22 is bolted on platform 20. A short shaft 24 extends through a bore in plate 22 and projects from its underside and through a sleeve 26 in the duct to extend partly within its inner space. A crank 28 is keyed to shaft 24 and is jointed to one end of a rod 30 whose opposite

end is jointed to a bracket 32 that is bolted excentrically on one side of shutter 12.

[0013] Shaft 24 is driven by a shutter-tripping unit that is arranged on plate 22, under a removable cover 33, and is shown in more detail on Figures 4 to 8.

[0014] With reference to Figures 4 to 8, a sprocket 34 is keyed to shaft 24 above plate 22 and is geared with a similar, free-wheeling sprocket 36, which itself meshes with a rack 38 slidable in a guide 40. An axial projection 42 of sprocket 36 has a radial arm 44, and a powerful spring 46 is wound around the projection to react between arm 44 and a nose 48 rising from plate 22. Arm 44 is normally rotated to the position shown on Fig. 4 against the bias of spring 46, and is retained in that position by a rocker pawl 50 that is journaled on a bracket 52 and is itself biased by a spring 54 to hook arm 44.

[0015] The shutter-tripping unit also includes a heat sensor 56 comprising a block 58 which extends into duct 10 through an opening in the duct wall, and which acts as a support for a stationary arm 60 as well as a guide for a sliding tappet rod 62. Rod 62 is retained by a low-melting fuse 64 against the bias of a spring 66 (more powerful than spring 54), which tends to drive rod 62 upwards to lift rocker pawl 50.

[0016] A linear actuator 68 is mounted on plate 22 so that it can push on a nose 70 on rack 38 and drive the rack rightward on Fig. 4 by a quarter turn, so that sprocket 36 is rotated clockwise to bring arm 44 to interact with rocker pawl 50. If the temperature in the duct is low, fuse 64 will hold down tappet 62, and pawl 50 will hook arm 44 and maintain it against the force of spring 46. If the air in the duct becomes overheated (say, above 60°C), fuse 64 will melt and release tappet 62, which will shoot upward under the action of spring 66 and lift pawl 50 to release arm 44 and allow sprocket 36 to rotate backward to its rest position, thereby driving the associated sprocket 34 to operate linkage 28-30-32 and turn shutter 12 closed.

[0017] Linear actuator 68 is preferably a nut-and-screw mechanism driven by an electric motor, as well known in the art, where the screw is a reversible, preferably multiple-threaded screw, so that it can be pushed back by nose 70 when spring 46 is released. However, linear actuator 68 might be of a different type, say an air cylinder.

[0018] The shutter-tripping unit also comprises a mechanism to allow its operation to be remotely tested. The testing mechanism comprises a lever 72, which is conveniently pivoted coaxially with sprocket 34. A remotely controlled electromagnet 74 normally retains an armature 76 connected with one end of lever 72, against the bias of a weak spring 78. The opposite end 80 of lever 72 is normally retained in a guide 82 adjacent to rocker pawl 50, and can act as a cam to interact with an extension 84 of rocker pawl 50, so that when electromagnet 74 is momentarily turned off to release armature 76 and to allow spring 78 to turn lever 72 clockwise, lever end 80 will interact with extension 84 to lift pawl 50 off

tappet 62, thereby releasing arm 44 of sprocket 36 and allowing it to turn counterclockwise under the action of spring 46 of a quarter turn, thereby driving sprocket 34 and its associated shaft 24 clockwise to close the shutter. During this movement, rack 38 will also be brought back, with nose 70 pushing back the unoperative linear actuator.

[0019] Also, in the counterclockwise movement of sprocket 36, a cam 86 integral with it will push against a shoulder 88 on lever 72 to bring it back to its position of Fig. 4, where lever end 80 is received within guide 82 and is away from pawl extension 84, and where armature 76 is again within the attraction of electromagnet 74.

[0020] In order that the operation of the shutter-tripping unit can be remotely monitored, the unit further comprises two microswitches 90, 92, which are tripped by respective prongs 94, 96 projecting radially from sprocket 34, at positions such that each switch checks on a respective one of the two stable positions (released and armed) of sprocket 36.

[0021] As an alternative, it is possible, say during maintenance or repair operations, to operate the device manually, by lowering extension 84 to release radial arm 44, and to subsequently reload spring 46 by turning projection 42 by means of a key (not shown) engaging its prismatic upper end.

[0022] In contrast to prior fire-arrester devices, the device according to the invention may be installed so that the shutter-tripping unit is well clear of the wall at which the fire-shutter is usually mounted. Moreover, the tripping unit of the inventive device has a high degree of compactness within a small enclosure, and the motor means for arming the unit (i.e. linear actuator 68) is mounted within the enclosure, rather than on top of it as in prior fire-arrester devices. Consequently, it is very easy and quick to access the entire mechanism for maintenance or repairs by merely removing cover 33, unhindered by either wall or motor, without having to disassemble any parts of the unit.

[0023] It should be understood that, although the fire-arrester device as disclosed above is mainly intended to have the shutter normally open and to trip it closed to create a barrier against the spreading of a fire from one room to the next, the device could be easily adapted, by merely changing the angle of the crank 28, to maintain a shutter normally closed, and to open it, under control of a fume detector, to disperse fumes along the duct, say in tunnel safety installations and the like.

## Claims

1. A shutter device for ventilation ducts, comprising a shutter (12) rotatable within a duct (10) between an open and a closed position, and a shutter-tripping unit supported on a base plate (22) mounted externally on the duct, and having a control unit (56) projecting within the duct for detecting an abnormal

- condition and releasing a spring-loaded mechanism to move the shutter to a tripped position, **characterized in that** the spring-loaded mechanism comprises a spring-driven rotatable shaft (24) extending through said base plate (22) and duct wall (10), a crank (28) keyed to the shaft and a linking rod (30) having one end linked to the crank and its opposite end linked to a bracket (32) carried eccentrically on one side of the shutter (12).
2. The shutter device of claim 1, **characterized in that** a first sprocket (34) keyed with the rotatable shaft (24) is geared with a second sprocket (36) loaded by a spring (46) wound around an axial projection (42) of the second sprocket and reacting between a radial arm (44) on the projection and a nose (48) on the base plate (22).
3. The shutter device of claim 2, **characterized in that** the tripping unit further comprises a pawl (50) adapted to retain said radial arm (44) in an armed position where said spring (46) is loaded, said control unit (56) cooperating with the pawl to lift it to free the radial arm.
4. The shutter device of claim 3, **characterized in that** it further comprises a lever (72) having a first end normally retained by a remotely controlled retaining member (74, 76) against the bias of elastic means (78) and a second end (80) cooperating with an extension (84) of said pawl (50) to release the pawl from the radial arm (44) when the lever rotates from a normal to a testing position.
5. The shutter device of claim 4, **characterized in that** said remotely controlled retaining member (74, 76) is an electromagnet (74) cooperating with an armature (76) connected to said first lever end, and said lever is biased to move to said testing position by a biasing spring (78).
6. The shutter device of any of claims 3 to 5, **characterized in that** a toothed rack (38), drivable by a linear actuator (68), meshes with said second sprocket (36) to rotate it to bring said radial arm (44) to its armed position.
7. The shutter device of claim 6, **characterized in that** said second sprocket (36) has a nose (86) cooperating with a shoulder (88) on the lever (72) to push the lever to its normal position when the second sprocket is rotated to its released position.
8. The shutter device of claim 7, **characterized in that** said first sprocket (34) has a first prong (90) cooperating with a first microswitch (94) when the tripping mechanism is in its released position.
9. The shutter device of claim 8, **characterized in that** said first sprocket (34) has a second prong (92) cooperating with a second microswitch (96) when the tripping mechanism is in its armed position.
10. The shutter device of any of claims 1 to 9, **characterized in that** said control unit (56) is a heat sensor placed within the duct.
11. The shutter device of any of claims 1 to 10, **characterized in that** said control unit (56) is a fume detector.



FIG. 2

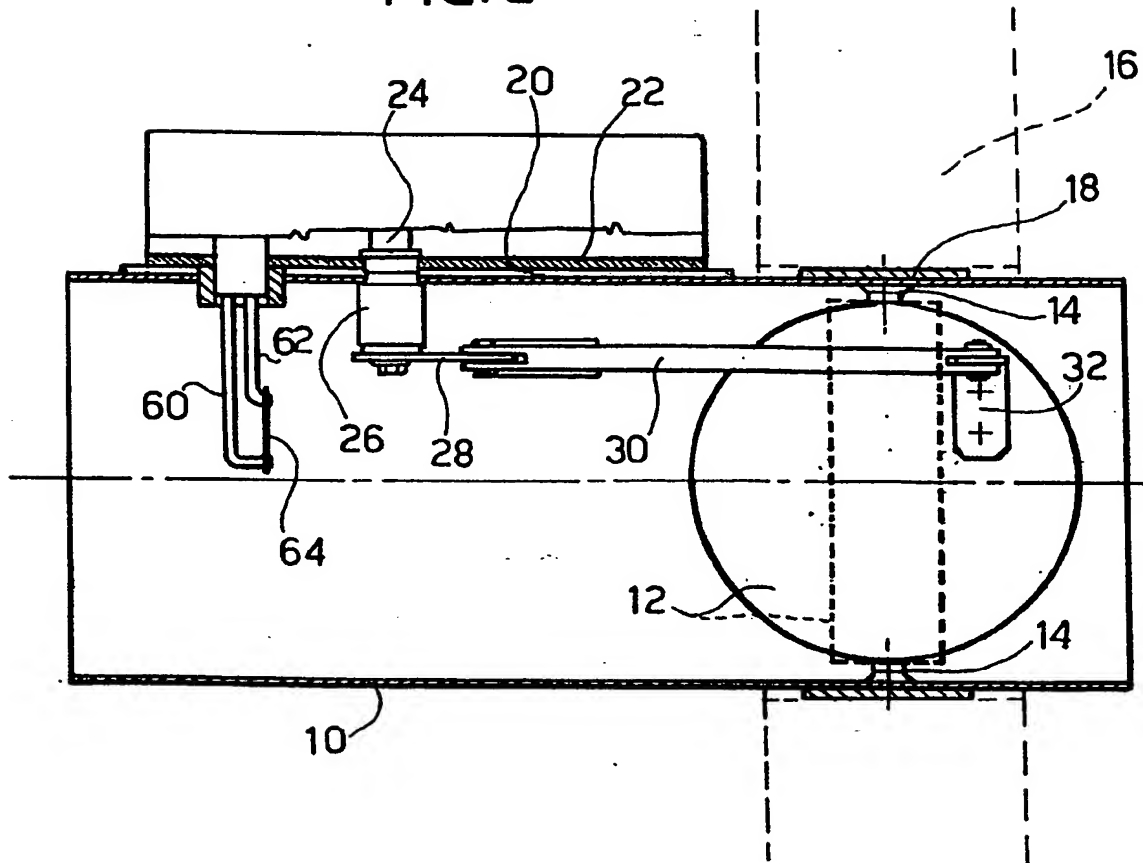
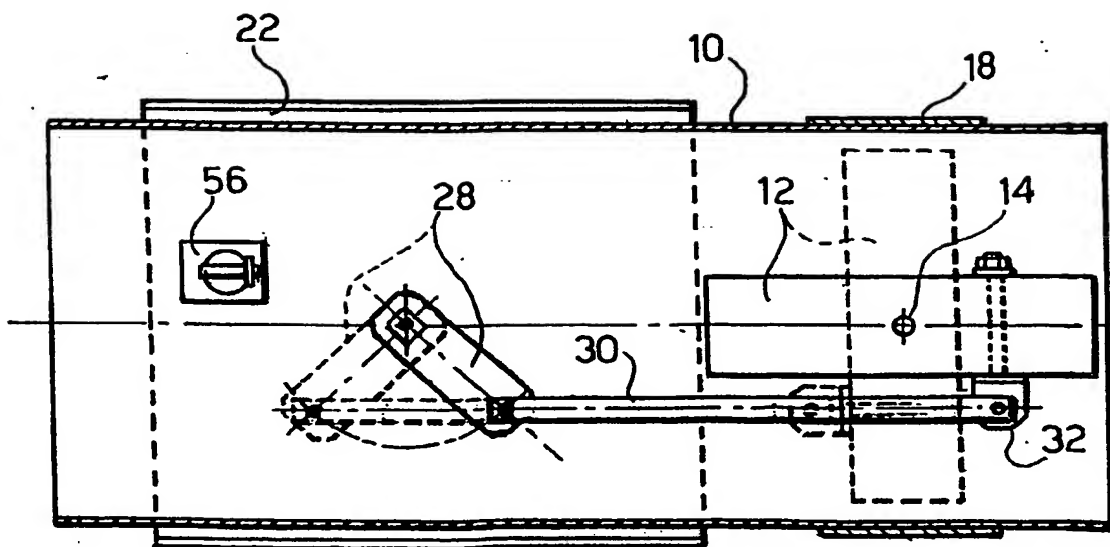
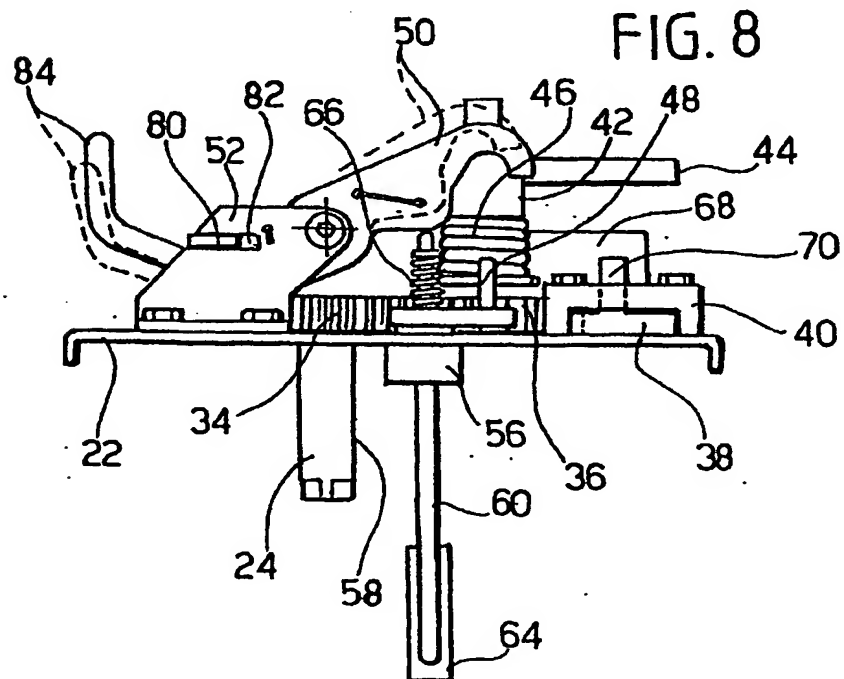
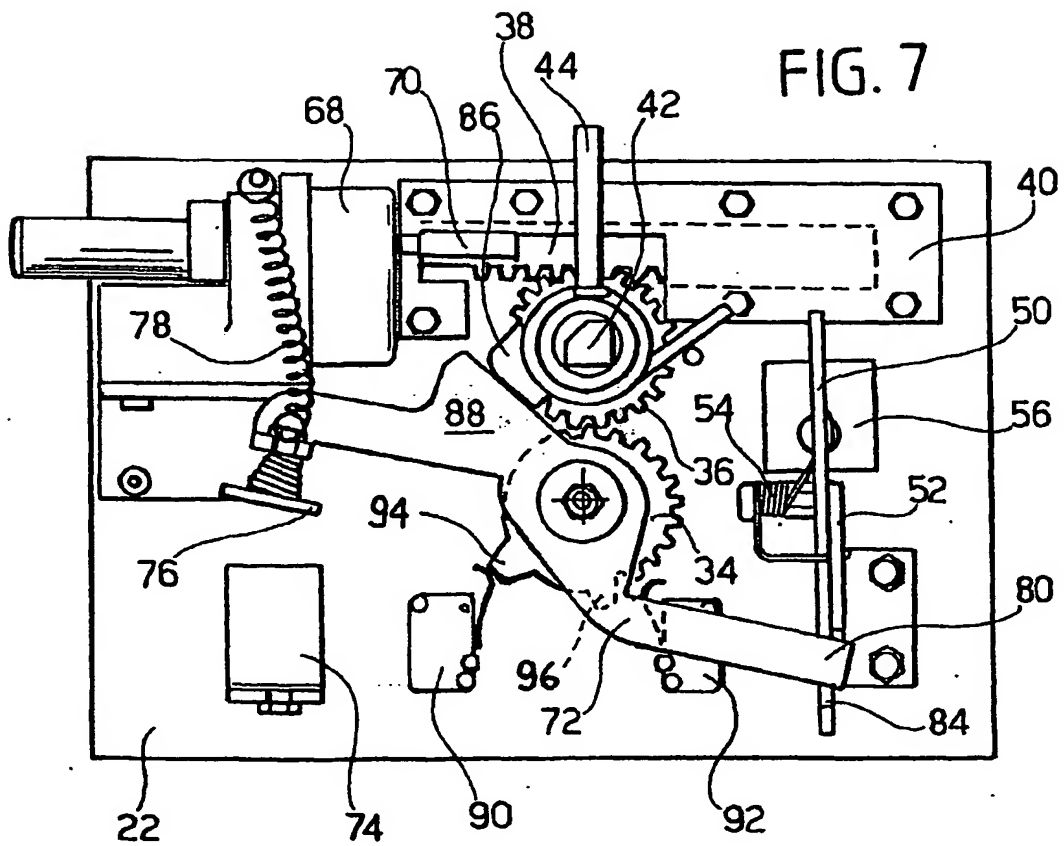


FIG. 3











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Application Number  
EP 01 83 0382

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The present search report has been drawn up for all claims			
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<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons</p> <p>&amp; : member of the same patent family, corresponding document</p>			

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**ANNEX TO THE EUROPEAN SEARCH REPORT  
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82